

CLAIMS

What is claimed is:

- 1 1. An electronic assembly comprising:
 - 2 a substrate,
 - 3 a device attached to the substrate;
 - 4 a thermally conductive heat spreader covering the device and at least a
 - 5 portion of the substrate; and
 - 6 a metal interposed between the device and the thermally conductive heat
 - 7 spreader, the metal having a lower melting point than the melting point of the
 - 8 thermally conductive heat spreader.
- 1 2. The electronic assembly of claim 1 wherein the thermally conductive heat
- 2 spreader further comprises:
 - 3 at least one column of the lower melting point metal.
- 1 3. The electronic assembly of claim 1 wherein the thermally conductive heat
- 2 spreader is cup-shaped.
- 1 4. The electronic assembly of claim 1 wherein the thermally conductive heat
- 2 spreader further comprises:
 - 3 a plate; and
 - 4 four sidewalls attached to the plate, the four sidewalls substantially
 - 5 surrounding the device attached to the substrate.
- 1 5. The electronic assembly of claim 1 wherein the device includes a die.

1 6. The electronic assembly of claim 5 further comprising an underfill material
2 located between the substrate and the die to prevent metal from entering the volume
3 between the die and the substrate.

1 7. The electronic assembly of claim 5 further comprising an encapsulation
2 material covering the die.

1 8. The electronic assembly of claim 1 wherein the device further includes:
2 a first die; and
3 a second die.

1 9. The electronic assembly of claim 7 wherein the first die and the second die
2 are stacked.

1 10. The electronic assembly of claim 9, wherein the first die and a second die
2 are covered with an encapsulating material.

1 11. The electronic assembly of claim 1 further comprising a heat sink thermally
2 attached to the thermally conductive heat spreader.

1 12. The electronic assembly of claim 1 wherein the metal substantially filling
2 the space between the device and the thermally conductive heat spreader is a solder
3 material.

1 13. The electronic assembly of claim 1 wherein the metal substantially filling
2 the space between the device and the thermally conductive heat spreader includes
3 indium.

1 14. The electronic assembly of claim 5 wherein the device further comprises
2 another component attached to the substrate.

- 1 15. The electronic assembly of claim 14 wherein the other component is covered
- 2 with an encapsulating material.

- 1 16. The electronic assembly of claim 14 wherein an underfill material is placed
- 2 between the other component and the substrate.

- 1 17. The electronic assembly of claim 1 wherein at least one of the surfaces in
- 2 contact with the interposed metal includes a wetting material.

- 1 18. A method comprising:
 - 2 attaching a die to a substrate;
 - 3 heating a mold;
 - 4 placing a thermally conductive heat spreader into the mold;
 - 5 placing the substrate into the mold; and
 - 6 flowing a molten metal material into contact with the thermally conductive
 - 7 heat spreader and the die.

- 1 19. The method of claim 18 further comprising underfilling the space between
- 2 the die and the substrate.

- 1 20. The method of claim 18 further comprising encapsulating the die.

- 1 21. The method of claim 18 wherein flowing a molten metal material into
- 2 contact with the thermally conductive heat spreader and the die includes flowing a
- 3 molten metal material through a gate in the mold and a gate in the thermally
- 4 conductive heat spreader.

- 1 22. The method of claim 18 further comprising cooling the mold and the
- 2 thermally conductive heat spreader to solidify the molten metal material.

1 23. The method of claim 18 further comprising placing a pressure on the molten
2 metal material.

1 24. The method of claim 23 wherein placing a pressure on the molten metal
2 includes maintaining a pressure substantially during flowing a molten material.

1 25. The method of claim 18 further comprising removing reactive components
2 from the space between the die and the thermally conductive heat spreader.

1 26. The method of claim 25 wherein removing reactive components from the
2 space between the die and the thermally conductive heat spreader further includes:

3 initially drawing a vacuum on the space between the die and the
4 thermally conductive heat spreader; and

5 purging the space between the die and the thermally conductive heat
6 spreader with a second gas.

1 27. The method of claim 26 wherein the second gas is less reactive than the first
2 gas.

1 28. The method of claim 26 further comprising drawing a second vacuum on the
2 space between the die and the thermally conductive heat spreader.

3 29. The method of claim 26 wherein the second gas is an inert gas.

1 30. The method of claim 18 further comprising adding a wetting layer to at least
2 one of the surfaces associated with the space between the substrate and the
3 thermally conductive heat spreader.

1 31. The method of claim 12 further comprising stacking a second die onto the
2 first die.

1 32. The method of claim 31 further comprising encapsulating the first die and
2 second die.

1 33. The method of claim 18 further comprising:
2 adding at least one other component to the substrate;
3 underfilling the at least one other component; and
4 encapsulating the at least one other component.

1 34. A method comprising:
2 attaching at least one die to a substrate;
3 placing a thermally conductive heat spreader over the die; and
4 interposing a molten metal material between the thermally conductive heat
5 spreader and the die.

1 35. The method of claim 34 further comprising attaching a second die onto the
2 substrate.

1 36. The method of claim 34 further comprising stacking a second die onto the at
2 least one die attached to the substrate.

1 37. The method of claim 34 further comprising cooling the molten metal
2 material after the space between the at least one die and the thermally conductive
3 heat spreader was filled with the molten metal material.

1 38. The method of claim 37 further comprising pressurizing the molten metal
2 material.

1 39. The method of claim 34 further comprising underfilling the space between
2 the die and the substrate.

1 40. The method of claim 34 wherein interposing a molten metal material further
2 comprises removing the molten metal material from a portion of a vessel that is not
3 exposed to the atmosphere.

1 41. The method of claim 34 further comprising adding a wetting layer to at least
2 one surface in the space between the die and the substrate.